

CLAIMS

What is claimed is:

1 1. A method comprising:
2 manufacturing a resonator beam having a first end and a second end, said resonator
3 beam suspended above a substrate by said first end and said second end, said resonator beam
4 having a first end connected to an actuator; and
5 using said actuator to applying an actuation force to resonator beam to apply strain
6 onto said resonator beam.

1 2. The method of Claim 1 wherein said actuator is a comb structure.

1 3. The method of Claim 1 wherein said actuator is a ratchet wheel.

1 4. The method of Claim 1 wherein said actuator is a ratchet wedge.

1 5. The method of Claim 1 wherein said actuator is a large coefficient of thermal
2 expansion heater.

1 6. The method of Claim 1 wherein said actuator is a ratcheting shaft.

1 7. The method of Claim 1 wherein said actuator is connected to said resonator beam
2 through a lever arm, said lever arm receiving said actuation force from said actuator and

3 transmitting said actuation force applied by said actuator proportionally to said resonator
4 beam.

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1 8. The method of Claim 7 wherein said actuation force supplied by said actuator is
2 proportional to a temperature.

1 9. The method of Claim 8 wherein a tensile strain is applied to said resonator beam as
2 said temperature increases.

1 10. The method of Claim 8 wherein a compressive strain is applied to said resonator
2 beam as said temperature increases.

1 11. The method of Claim 7 wherein said actuator is a comb structure acting on said lever
2 arm.

1 12. The method of Claim 7 wherein said actuator is a ratchet wheel that engages said
2 lever arm.

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1 13. The method of Claim 7 wherein said actuator is a ratchet wedge that acts on said lever
2 arm.

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1 14. The method of Claim 7 wherein said actuator is a large coefficient of thermal
2 expansion heater acting on said lever arm. ✓

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1 15. The method of Claim 7 wherein said actuator is a ratchet shaft acting on said lever
2 arm.

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1 16. The method of Claim 11 wherein said comb structure exerts force on a curved beam
2 that in turn transmits force onto said lever arm.

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1 17. The method of Claim 8 further comprising connecting said second end of said
2 resonator beam to a second lever arm and using said second lever arm in concert with said
3 first lever arm to apply a strain to said resonator beam.

1 18. The method of Claim 17 wherein said actuator applies said actuation force to both
2 said lever arm and said second lever arm.

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1 19. The method of Claim 17 wherein said lever arm and said second lever arm rotate
2 about a pivot point so as to proportionally modify the amount of strain applied to said
3 resonator beam.

1 20. The method of Claim 7 wherein said actuator is an expansion bar that provides said
2 actuation force proportional to a temperature.

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1 21. An apparatus comprising:
2 a resonator beam having a first end and a second end, said resonator beam suspended
3 above a substrate by said first end and said second end; and
4 an actuator connected to said first end of said resonator beam, said actuator applying
5 an actuation force to said resonator beam to apply strain onto said resonator beam.

1 22. The apparatus of Claim 21 wherein said actuator is a comb structure.

1 23. The apparatus of Claim 21 wherein said actuator is a ratchet wheel.

1 24. The apparatus of Claim 21 wherein said actuator is a ratchet wedge.

1 25. The apparatus of Claim 21 wherein said actuator is a large coefficient of thermal
2 expansion heater.

1 26. The apparatus of Claim 21 wherein said actuator is a ratcheting shaft.

1 27. The apparatus of Claim 21 further comprising a lever arm, said actuator connected to
2 said resonator beam through said lever arm, said lever arm receiving said actuation force
3 from said actuator and transmitting said actuation force applied by said actuator
4 proportionally to said resonator beam.

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1 28. The apparatus of Claim 27 wherein said actuation force supplied by said actuator is
2 proportional to a temperature.

1 29. The apparatus of Claim 28 wherein a tensile strain is applied to said resonator beam
2 as said temperature increases.

1 30. The apparatus of Claim 28 wherein a compressive strain is applied to said resonator
2 beam as said temperature increases.

1 31. The apparatus of Claim 27 wherein said actuator is a comb structure acting on said
2 lever arm.

1 32. The apparatus of Claim 27 wherein said actuator is a ratchet wheel that engages said
2 lever arm.

1 33. The apparatus of Claim 27 wherein said actuator is a ratchet wedge that acts on said
2 lever arm.

1 34. The apparatus of Claim 27 wherein said actuator is a large coefficient of thermal
2 expansion heater acting on said lever arm.

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1 35. The apparatus of Claim 27 wherein said actuator is a ratchet shaft acting on said lever
2 arm.

1 36. The apparatus of Claim 31 wherein said comb structure exerts force on a curved beam
2 that in turn transmits force onto said lever arm.

1 37. The apparatus of Claim 28 further comprising a second lever arm connected to said
2 second end of said resonator beam and using said second lever arm in concert with said first
3 lever arm to apply a strain to said resonator beam.

1 38. The apparatus of Claim 37 wherein said actuator applies said actuation force to both
2 said lever arm and said second lever arm.

1 39. The apparatus method of Claim 37 wherein said lever arm and said second lever arm
2 rotate about a pivot point so as to proportionally modify the amount of strain applied to said
3 resonator beam.

1 40. The method of Claim 37 wherein said actuator is an expansion bar that provides said
2 actuation force proportional to a temperature.

1 41. A temperature compensated resonator comprising:

2 a resonator beam having a first end and a second end, said resonator beam suspended
3 above a substrate by said first end and said second end; and

4 an actuator connected to said first end of said resonator beam, said actuator applying
5 an actuation force to said resonator beam to apply a tensile strain onto said resonator beam,
6 said actuation force dependent upon a temperature.

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1 42. The apparatus of Claim 41 wherein said actuator is an expansion bar.

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1 43. The apparatus of Claim 41 further comprising a lever arm, said actuator connected to
2 said resonator beam through said lever arm, said lever arm receiving said actuation force
3 from said actuator and transmitting said actuation force applied by said actuator
4 proportionally to said resonator beam.

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1 44. The apparatus of Claim 43 wherein said actuator is an expansion bar acting on said
2 lever arm.

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1 45. The apparatus of Claim 43 further comprising a second lever arm connected to said
2 second end of said resonator beam and using said second lever arm in concert with said first
3 lever arm to apply said tensile strain to said resonator beam.

1 46. The apparatus of Claim 45 wherein said actuator applies said actuation force to both
2 said lever arm and said second lever arm.

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1 47. The apparatus method of Claim 46 wherein said lever arm and said second lever arm
2 rotate about a pivot point so as to proportionally modify the amount of tensile strain applied
3 to said resonator beam.

1 48. A temperature sensor comprising:
2 a resonator beam having a first end and a second end, said resonator beam suspended
3 above a substrate by said first end and said second end; and
4 an actuator connected to said first end of said resonator beam, said actuator applying
5 an actuation force to said resonator beam to apply a compressive strain onto said resonator
6 beam, said actuation force dependent upon a temperature.

1 49. The apparatus of Claim 48 wherein said actuator is an expansion bar.

1 50. The apparatus of Claim 48 further comprising a lever arm, said actuator connected to
2 said resonator beam through said lever arm, said lever arm receiving said actuation force
3 from said actuator and transmitting said actuation force applied by said actuator
4 proportionally to said resonator beam.

1 51. The apparatus of Claim 50 wherein said actuator is an expansion bar acting on said
2 lever arm.

1 52. The apparatus of Claim 50 further comprising a second lever arm connected to said
2 second end of said resonator beam and using said second lever arm in concert with said first
3 lever arm to apply said tensile strain to said resonator beam.

1 53. The apparatus of Claim 51 wherein said actuator applies said actuation force to both
2 said lever arm and said second lever arm.

1 54. The apparatus method of Claim 53 wherein said lever arm and said second lever arm
2 rotate about a pivot point so as to proportionally modify the amount of tensile strain applied
3 to said resonator beam.

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